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ABSTRACT

Developed for teachers of junior high school science classes, this unit presents ten investigations on plant growth, animal life, pond life, and general science interests. These investigations are designed to accompany any popular life science textbooks, may be used to supplement a year-long course in life science, are intended as a springboard for further student study, are written for a wide range of student abilities, and contain hands-on activities. The materials required for these investigations are commonly found in junior high science classrooms or in high school chemistry stockrooms. The following investigations are presented: (1) plant growth; (2) plant growth and nutritional deficiency; (3) the colorful coleus (photosynthesis); (4) tropism (growth patterns in plants); (5) a friend of the soil (earthworm); (6) life in a rotting log (story of succession); (7) life in a pond; (8) plant and animal cells; (9) water and soil analyses; and (10) construction of a terrquarium (a multipurpose, combination terrarium and aquarium). The format varies for each of these investigations but many contain an introduction, procedures, materials required, and followup studies. Some contain additional activities, questions, notes to the teacher, and observations. This document is part of a collection of materials from the Iowa Area Education Agency 7 Teacher Center project. (EM)

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INVESTIGATIONS

IN

LIFE SCIENCE

JUNIOR HIGH

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INTRODUCTION

To The Teacher:

This series of Investigations in Life Science has been written for use in the junior high science classroom. The investigations are divided into the following basic areas of study:

1. Plant Growth
2. Animal Life
3. Pond Life
4. General Interest

They can accompany any of the popular life science textbooks. With proper planning for the securing of living materials there may be enough investigations to supplement a year-long course in life science.

The material contained in each investigation is not intended to be totally complete as written. It is hoped that students would research the topic in the school library as their work continues throughout the study. By utilization of library, classroom, and teacher resources it is felt that these studies could have a springboard effect. Other areas of potential interest are certain to be encountered during their research.

These materials have been written to appeal to a wide range of student abilities. They have all been designed to include many hands-on activities. They should appeal to those students wishing to carry out project work last a few days or sometimes weeks. The materials used are commonly found in a junior high science classroom. The living material is easy to secure and keep alive. The chemicals used in the plant nutrition studies although not necessarily common to a junior high science stockroom are commonly found in a high school chemistry stockroom.

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PLANT GROWTH

THE LEMNA MINOR STORY

Introduction

Plant growth studies are an interesting activity that can produce results helpful to persons involved in growing plants. Most studies involve the feeding of the selected plants solutions that contain all the elements necessary for plant growth. The seven elements that have been identified as being essential for growth are nitrogen, phosphorus, potassium, sulfur, calcium, magnesium, and iron. Chemical compounds that contain these elements are made into water solutions and fed to plants. The importance of an element to the growth of the plant can be investigated by making a nutrient solution that does not contain the element under study.

Plant Selection

The plant used in this study is a very common plant that can be found growing on the surface of most ponds. It is called duckweed. The scientific name for duckweed is Lemna minor. Duckweed is valuable for plant growth studies because of its small size, rapid growth, and simplicity. These plants float on the surface of water and are simple to care for. Light, temperature, and nutrition are very easy to control. They do not require soil for growth.

The growth of duckweed can be followed by making frond counts. A frond is an individual duckweed plant. The fronds are flat, oval in outline, and leaf-like. They contain only one thread-like root on each frond. Duckweed produce new "daughter" fronds from pockets on each side of the "mother" frond.

Materials Required

1. Potassium chloride, KCl
2. Primary potassium phosphate, KH_2PO_4
3. Magnesium sulfate, $MgSO_4 \cdot 7\ H_2O$
4. Calcium nitrate, $Ca(NO_3)_2 \cdot 4\ H_2O$

5. Iron (III) tartrate, $Fe_2(C_4H_4O_6)_3$
6. Six - one litre flasks
7. Six clean rubber stoppers
8. Distilled water
9. Balance
10. Duckweed

Procedure

Solution Preparation - All glassware should be washed and clean.

1. Add about 0.5 litre of distilled water to each flask.
2. Measure out the following amount of each chemical
   a. 6.0 gram KCl
   b. 6.0 gram KH_2PO_4
   c. 9.0 gram $MgSO_4 \cdot 7\ H_2O$
   d. 10 gram $Ca(NO_3)_2 \cdot 4\ H_2O$
   e. 0.6 gram $Fe_2(C_4H_4O_6)_3$

   Add one compound to each flask. Shake to dissolve. Add more water to make one litre of solution. Label each flask as to its contents.
3. Measure out 50 mL (millilitre) of each stock solution and add them all to another flask. Add 750 mL of water to make one litre of solution. Label "Complete Nutirent" solution.

4. Label six clean 250 mL beakers as follows:
   1 and 2 Distilled water
   3 and 4 Tap water (boiled to remove chlorine)
   5 and 6 Nutrient Solution
5. Visit a pond and collect a quantity of water containing duckweed. Store in gallon jars or an aquarium.

6. Using tweezers, carefully select a healthy duckweed frond and remove any daughter fronds by gently pulling them away from the mother frond. Place the mother frond on the surface of beaker number 1. Repeat this process until 10 fronds are in each beaker.
7. Set the beakers in an area where the temperature is fairly constant and natural light is available. A growth chamber could be made from a cardboard box. An ultraviolet or grolux lamp could be used as the light source replacing natural light.
8. Observe the containers daily and keep an accurate count of frond number. Count the daughter fronds even though they may be attached to the mother frond. Continue the experiment until you feel a sufficient number of fronds have been produced in the nutrient solution. Average the frond counts for the duplicate samples.
9. Make a graph of the results. Plot frond count on the vertical axis and days on the horizontal axis. Using colored pencil or pens, plot the three results on the same graph. Label each curve.

Followup

Write a brief report explaining the purpose of the study and the experimental results. Draw conclusions as to the importance or lack of importance of the role of nutrients in plant growth. Research plant growth in the school library and visit local plant stores and ask for copies of pamphlets that describe the use of fertilizers.

PLANT GROWTH AND NUTRITIONAL DEFICIENCY

LET'S LEAVE SOMETHING OUT

Introduction

This investigation can be done at any time during the school year. It uses common vegetable garden type plants that can be started as seeds. Washed sand replaces the water solutions that were used in the duckweed study. The same solutions are used in this investigation as were used in the duckweed study.

Solution Preparation

Nutrient solutions deficient in (1) nitrogen, (2) phosphorus, and (3) potassium are prepared as follows:

1. Nitrogen Deficient
   - 50 mL KCl
   - 50 mL KH_2PO_4
   - 50 mL $MgSO_4 \cdot 7\ H_2O$
   - 200 mL $CaSO_4 \cdot 2\ H_2O$ (1.8 grams/litre distilled water)
   - 50 mL $Fe_2(C_4H_4O_6)_3$
   - 600 mL distilled water

2. Phosphorus Defficient
   - 77 mL KCl
   - 50 mL $MgSO_4$
   - 50 mL $Ca(NO_3)_2$
   - 50 mL $Fe_2(C_4H_4O_6)_3$
   - 773 mL distilled water

3. Potassium Deficient
   - 50 mL NaCl (4.7 g/ litre)
   - 50 mL $NaH_2PO_4 \cdot H_2O$ (6.1 g/litre)
   - 50 mL $MgSO_4$
   - 50 mL $Ca(NO_3)_2$
   - 50 mL $Fe_2(C_4H_4O_6)_3$
   - 750 mL distilled water

Preparation of Seedlings

Corn plants work well in a study such as this. Germinate about 24 corn seeds by the following method. Soak the seed overnight in distilled water. Cover the bottom of several petri dishes with two layers of paper towel, moisten with distilled water, and place the water soaked seeds in the petri dishes. Cover and set aside until germination has started.

Fill five clay pots or large beakers with washed sand. Transplant four seedlings to each pot. Total seedlings equals twenty. Label the pots (1) water only, (2) complete nutrient, (3) nitrogen deficient, (4) phosphorus deficient, and (5) potassium deficient.

Adding of Nutrient Solutions

1. Add distilled water to pot 1 using a graduated cylinder. Keep track of the amount of water needed to just moisten the sand thoroughly.
2. Add the same amount of
   a. Complete nutrient solution to pot 2 (directions for this solution can be found in the Plant Growth-Lemna minor Story investigation).
   b. Nitrogen deficient solution to pot 3.
   c. Phosphorus deficient solution to pot 4.
   d. Potassium deficient dolution to pot 5.
3. Place the plants in a good growing location. Observse every 24 hours. IMPORTANT: ADD DISTILLED WATER TO EACH POT TO MAINTAIN PROPER MOISTURE CONTENT.
4. Add 25 mL of the respective nutrient solution to the proper pot every three days.
5. Continue the investigation for four to six weeks or until the proper growth has been reached in pot 2.
6. Keep an accurate record of heights of each plant each day or so.

Conclusion

When it has been decided to terminate the investigation remove each plant from its pot. Inspect root development, stem development, and overall health of the plant. Keep a record of your observations. This is probably the most important part of this entire investigation.

Write a brief report stating the nature of the problem, the procedure followed, the results, and conclusions of your study.

Library Research

Visit the library and study those books that contain information on plant growth. Check into getting information from local nurseries concerning the use of fertilizers on grass and other plants.

THE COLORFUL COLEUS

PHOTOSYNTHESIS AND PLANT GROWTH

Introduction

There was a time on this planet when there were no green plants. All organisms subsisted on molecules made in air and water. The entire process was very inefficient and limited the growth and development of plant life. It was not until chlorophyll came on the scene that the door was opened for the expansion of the life forms that lead to our present form of plants and animals. With the coming of cholorphyll, what has been called the single most important physical, chemical, and biological process was able to come into existence. That process is photosynthesis.

Green plants need sunlight for growth. This can be shown by taking two similar plants and keeping one in the dark and one in the light for several days and observing the appearance of the plants. Part of this investigation depends upon the plants ability to use sunlight. Green plants also need carbon dioxide to make food. Without this ability plants would die very soon. Minerals are also necessary for healthy plant growth. The importance of nitrogen, phosphorus, and potassium as well as sulfur, calcium, magnesium, and iron was investigated in another investigation in this series.

Many life science textbooks describe experiments using geranium plants that show the importance of sunlight and carbon dioxide to the growth of plants. Look some of these up in life science books and devise your own experiment to investigate these claims.

The purpose of this investigation is to discover if chlorophyll is necessary for the production of food by plants. A good type of plant to use for this study is Coleus. Coleus is a plant which has multi-colored leaves. Some parts of the leaves are distinctly green, white, or red. If this study was to be done in mid-year the plant could be grown from seed. However, Coleus is a common plant and can be purchased at a plant store.

Green plants are green because they contain chlorophyll which is green. The white parts of the Coleus leaf therefore do not contain chlorophyll. In this investigation the need for chlorophyll in food production can be determined by finding out if food is able to be produced in the white areas of the leaf.

Food is stored in plants as starch. Starch is made from a sugar called glucose. Glucose is the food that is originally formed by the photosynthesis process. The series of chemical reactions is very complex. It is common to write the overall reaction as follows:

$$\text{carbon dioxide + water} \xrightarrow[\text{chlorophyll}]{\text{light}} \text{glucose + oxygen}$$

The chemical test to find if glucose is formed is complex. A much more simple test to perform is to test for the formation of starch. This test uses an iodine solution which turns blue-black when it comes into contact with starch.

Procedure

1. To find out if chlorophyll is needed for food production remove a healthy leaf containing <u>both</u> green and white portions from a Coleus plant.
2. Remove the chlorophyll from the leaf using the following method:
   a. Place the leaf in boiling water for about two minutes.
   b. Place a glass beaker about one-third full of alcohol in a pan of boiling water. Place the Coleus leaf in the alcohol and boil until the chlorophyll is removed from the leaf. The leaf will turn white. BE CAREFUL: DO NOT USE AN OPEN FLAME SUCH AS A BUNSEN BURNER FLAME. THE ALCOHOL COULD CATCH FIRE!
3. Rinse the leaf in water, place on a paper towel and remove the surface water by blotting with a paper towel.
4. Using a bottle of iodine solution and a medicine dropper, cover the leaf with iodine solution. What do you observe?

5. Is the entire leaf
   a. white (yes or no)
   b. blue-black (yes or no)
   Describe the appearance of the leaf. Write a brief statement which can account for your observations.
6. Is chlorophyll needed by the plant for food production?
7. Why remove the chlorophyll from the leaf before testing for the presence of starch?
8. In what way is the photosynthesis process useful to humans?

TROPISM - GROWTH PATTERNS IN PLANTS

LIGHT OF MY LIFE

Introduction

You may be familiar with the fact that our bodies can produce hormones which regulate many functions of our bodies. Human growth and development as well as the thickening of an animals fur are all regulated by hormones. Flowering in plants and the shedding of leaves in the fall by trees are triggered by hormones that bring about specific reactions in plants. In plants, hormones are produced in the stems, roots, and the tips of leaves which are all growing regions of plants.

In this investigation you will study the effects of light and gravity on hormone production in plants. In biology, patterns of growth are called tropisms. Tropisms can be either positive or negative. Growth that goes toward a stimulus such as light is called positive tropism. Growth away from a stimulus is called negative tropism.

Procedure

Activity 1 - The Effect of Light On Plant Growth

Plant a half dozen radish seeds in soil placed in a styrofoam cup or a small glass jar. Water the soil and place on a windowsill. or under a growing light. Observe every day, watering when necessary, and when the plants are 4 to 5 cm tall note whether they are growing toward or away from the light source. Turn the plants and observe in which direction the leaves grow.

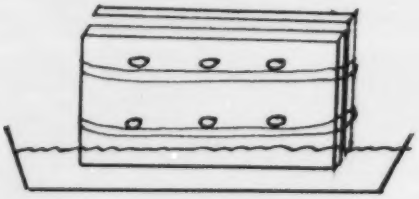
It might be interesting if you prepare a second growing pot containing seeds. Keep this pot in the dark at all times. Discover whether seeds can germinate in the dark and if they need light for growth. Keep a record of your observations and write a brief report of the investigation and your findings.

Activity 2 - The Effect of Gravity On Plant Growth

Procedure

Materials Required: Four glass plates about 10 cm square, 12 radish seeds, paper towel, dish or glass jar large enough to hold glass plates in an upright position.

1. Soak the seeds overnight in water.
2. Fold the paper towel so it is the same size as the glass plates. Wet with water and place on the glass.
3. Place six of the seeds evenly spaced on the paper towel. Cover with the second glass plate and hold together with two rubber bands. The setup will look like this:



4. Repeat steps two and three. Place both in separate dishes containing a small amount of water.
5. Place one in the dark and the other in the light. Leave for a few days. When the roots are about 1 cm long, draw a sketch of their appearance. Then turn each plate upside down in the dishes. Return the proper setup to the dark.
6. Leave for a few more days, checking their appearance every day. Draw a sketch of their appearance.

Followup

1. Compare the final positions of the roots with their position after Step 5. Record your observatoons.
2. Write a brief report of your study. Include the sketches. What was the purpose of the second setup which was placed in the dark? Did the roots appear to be affected by gravity? Would you call this effect positive or negative geotropism?

Additional Notes

It is interesting to consider what causes the plants to grow toward light. First think about the following questions. Form your answers and then read further.

Questions

1. In what direction will the stem grow?
2. Which side of the stem has had the fastest growth?
3. Since hormones can regulate growth, to which side of the stem have the hormones moved? Have the hormones moved away from or toward the light?

Plant hormones move away from light to the shaded parts of the plant. The hormones have moved toward side 1 causing faster growth on that side of the stem. This faster growth results in the plant growing toward the light source. Because of this positive phototropism, plants should be moved from time to time.

A FRIEND OF THE SOIL

LUMBRICUS TERRESTRIS

Introduction

The common earthworm, Lumbricus terrestris, is an interesting little fellow. Very abundant in most areas, they survive best in loosely packed soil high in organic, decaying matter. Most everyone has picked up a decayed tree limb or old, dead leaves and discovered earthworms underneath. They like moist environments because of the nature of their outer skin. It is very thin and soft and drys out easily. For this reason they like moist soils.

Earthworms are burrowers. They like soils that are loosely packed since these contain the air or oxygen they need for survival. When soil becomes hard packed the only way they can continue to move is by swallowing the soil. The soil is digested and then excreted and packed along the walls of their tunnels in the loose, air containing space. If the soil is hard packed the earthworm must come to the surface and leave their waste close to their tunnel entrance. Most likely you have seen these "castings" around the earthworm burrows or tunnels. In winter they burrow deeply into the soil below the frost line

Activities With Earthworms

Activity 1 - Soil Analysis

The soil analyses referred to can be conducted using the soil testing kits available through the Area Education Agency 7. The tests are not complicated and can be run by students after some practice.

The castings made by earthworms can greatly enrich the soil. The castings are very high in mineral content containing large amounts of nitrogen, phosphorus, and potassium. In this activity two boxes are constructed and both filled with identical soil samples. Earthworms are introduced to only one box and identical care is given to both. Chemical analysis of the soil from both boxes is done at various time

intervals depending upon the length of the experiment.

Procedure

1. Construct two wooden boxes with identical dimensions, approximately 15 cm square and 15 cm high. Make a cover using small mesh window screening. Do not tack the screening in place yet.
2. Get approximately one-half pail full of natural topsoil containing some decaying leaves and little bits of wood. It is important to do the same procedure to both boxes of topsoil with the exception that earthworms are placed only in one of the boxes. Fill each box about two-thirds full of topsoil. Equal amounts of lettuce can be cut up and mixed with the soil in both boxes. Add about six earthworms to one box and label it experimental. The other box is labeled control. Water lightly but do not soak the soil. Tack the wire screen in place making making certain that the earthworms can not get out of the box. Sprinkle, through the screening, with just enough water to keep the soil moist.
3. At the end of one month remove the screening and dump the soil into two large pans. Remove the earthworms and return them to a natural environment. Uniformly mix the soils and conduct a chemical analysis on both the experimental and control samples.
4. Write a brief report of your experiences. Include the following parts in your report.
   a. Title
   b. Purpose
   c. Procedure
   d. Results
   e. Conclusions
   f. List of references of readings on earthworms.

Teacher Notes

1. While the investigation is being conducted the student(s) can do some library research on earthworms. Stress that experiments do not necessarily give immediate results and that for this reason this investigation is conducted over a long period of time.

2. Students should keep the soil samples until after the analyses are completed. If differences are not found, return the soils to the boxes, add worms, and continue for another month.

3. This investigation could be the basis for a science fair project.

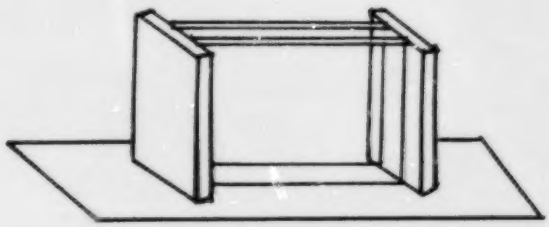
Activities With Earthworms

Activity 2 - Earthworm Behavior

Introduction

The behavior and effect of one earthworm on a soil sample will be studied in this investigation. Cast formation, burrowing, intermixing of soil, and the digestion of plant material will be considered.

Construct the glass and wooden framed apparatus as follows. A strip ow wood approximately one by two inches and thirty inches long is used to make the frame. Using a table saw, two cuts are made about three-eighths inches apart. Depending upon the glass size, approximately nine by twelve inches, the strip of wood is cut into three pieces to enable the frame to be made. The bottom part of the frame is nailed to a larger piece of wood for support.

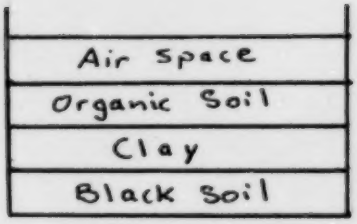


Three types of soil are needed in this investigation. They are black soil, light colored clay, and an organically rich soil.

Procedure

1. Do not water the soils before adding them to the apparatus.
2. Place a layer of each soil type two inches deep in the frame according to the diagram. Lightly water each layer after putting it in the frame. Use a funnel and a piece of rubber tubing. Try not to wet the inner glass surface above each layer.

2. continued



3. Draw a line with a marking pen across the glass to show the upper level of the top layer.
4. Cut up some lettuce into small pieces and place on the soil surface.
5. Add one earthworm that appears healthy!
6. Tape a piece of wire screen over the top of the apparatus. Do not tape the opening closed with tape as the earthworm must have air in order to survive.

Observations

1. Place the apparatus in a dark area for 24 hours.
2. Using the marking pen draw a line indicating any change in the upper level of the soil.
3. Calculate any change in soil volume.
4. Trace the path the earthworm made during the 24 hours. Determine the length of the tunnel.
5. Calculate the distance the earthworm could travel in one seven day week.
6. Measure the amount of tunneling done in each soil layer. How much intermixing of soil layers took place in 24 hours?
7. Continue the investigation for another 24 hours and note any further changes in soil volume.

Followup

Write a brief report outlining the purpose, procedure, results, and conclusions of your investigation.

LIFE IN A ROTTING LOG

A STORY OF SUCCESSION

Introduction

A rotting log passes through a number of different stages before it completely decays and becomes a part of the soil. During these stages, various forms of life occur within the log. The organisms in each stage live until they use up their food supply. They are then succeeded by other organisms. The process is repeated many times until the log returns to the soil. This process is called succession.

This investigation is most easily carried out in a woodland setting. If a field trip is not possible, logs in various stages of decay can be brought into the classroom for study. If the study is done indoors first cover the table with plastic or newspapers. Cross sections of the logs can be cut to give each student a section about 15 to 20 cm long. Half a dozen small pill bottles with cork stoppers can be used to store the organisms found in the log.

Procedure

1. Remove the bark and look for organisms under the bark and in the surface of the wood. Place any organisms that you find in the pill bottle and label its source.
2. Using an ordinary table knife, break apart the rotting wood, carefully looking for organisms. Bottle and label any that you find. Keep a written record stating where the organisms were found. Note the color, water content, odor, etc. of the wood.
3. Clean up the work area and if possible return the bits and pieces of rotten wood to an outdoor natural area.
4. Compare the organisms with those found by other students. Note any similarities and differences.

5. If many different organisms were found a display could be prepared as a class or individual project.
6. If a permanent collection is going to be made an insect killing jar will be required. Instructions for preparing such a jar are as follows:

An insect killing jar can be made from a small glass bottle such as a childs vitamin bottle or a small baby food jar very easily. The chemicals can be found in the high school chemistry storeroom. Make enough paste of plaster of Paris (calcium sulfate) to make a layer about 2 cm thick in the bottom of the jar or bottle. Let the container sit for a day until the plaster is dry or even better warm in an oven until dry (about $200^{o}F$). Pour in only enough ethyl acetate to moisten the plaster. Crumple a small amount of paper (not too absorbent) and place in the bottle. Cap tightly. Cover the bottle with adhesive tape leaving a small part untaped for viewing the insect in the bottle. Label the bottle "Insect Killing Bottle", "Do Not Inhale Vapors". To use, place the organism inside the bottle, cap, and wait about five minutes or until the organism is dead. Remove and place the organism in a small bottle for storing and later use.

LIFE IN A POND

I CAN'T BELIEVE MY EYES

Introduction

The word ecology is derived from two Greek words which, when combined, mean "a study of the home." In this investigation you will be studying a freshwater system called the pond. Our world is made up of many different kinds of "homes." A pond is much like a "mini-world." There are many groups of living organisms that exist within a physical environment. These groups of organisms along with their physical environment are given the name ecosystem. The plants and animals that make up an ecosystem are given the name biotic. The non-living parts such as the soil, water, and air are given the name abiotic. The biotic and abiotic components interact with each other. This is the most important thing an ecosystem has going for it.

A study of a natural pond would lead you to discover that there are different parts to the pond. There is the surface upon which some plants and animals float, the open water where small fish may live, and the bottom where snails and crayfish live. These three distinct areas, the surface, open water, and bottom, are called habitat. One of the concerns of a person interested in ecology is the disturbing or upsetting of a natural habitat. The ecologist studies ways to protect the ecosystems that may be endangered.

Collecting Pond Water

It is not always possible to go into the field to study an ecosystem such as a pond. The next best thing is to bring the pond into the classroom. In this investigation, gallon jars are filled with pond water. This can be done in several ways. Three one gallon jars are required. One is filled with water taken from the surface of the pond. Include any floating plants such as duckweed. Another is filled with water taken close to the bottom including bottom debris such as mud and bottom plants. The third can be filled with water

from the surface, close to the bottom, and from the middle depths of the pond. Include mud and plants with the samples. This third jar will be representative of the entire life in the pond.

The jar containing the bottom sediment should be allowed to settle and remain undisturbed for a short time. In a similar way, let the representative sample settle. Label the jars, surface, representative, and bottom.

Procedure

Materials needed: Microscope, microscope slides, cover slips, medicine dropper.

1. Place one drop of surface pond water on a glass slide and cover with a cover slip. Do not press down on the cover slip.
2. Place the slide on the microscope stage. Using the low power objective, study the drop of water. Move the slide from side to side to enable you to observe the entire area under the cover slip.
3. Examine the water under the high power magnification as you did in step 2.
4. Prepare a new slide using the bottom pond water. Observe under both the low and high power magnification.

Questions

1. Describe the organisms found in the water samples. Make a sketch of each organism. Are the organisms in the samples identical?
2. Why may certain organisms be found only near the top of the pond water? Near the bottom?
3. Ask your teacher to show you a taxonomy key that describes the various protozoans. Identify those you found by comparing your sketches with those found in the key.

Library Research

Find some references that describe the various kingdoms such as the protist and animal kingdom. How do they differ?

Additional Studies

Add some lettuce or hay to some distilled water. Let sit for a few days and observe some of the water under a microscope. Describe what you find.

PLANT AND ANIMAL CELLS

The purpose of this activity is to help introduce you to the cell.

ACTIVITY 1: WHAT ARE CELLS

Get a piece of cork and a microscope. Your teacher will show you how to properly handle a microscope. Remember, always carry a microscope using both hands. Using a razor blade (be careful), make some cork dust by scraping the side of the cork with the razor blade a few times.

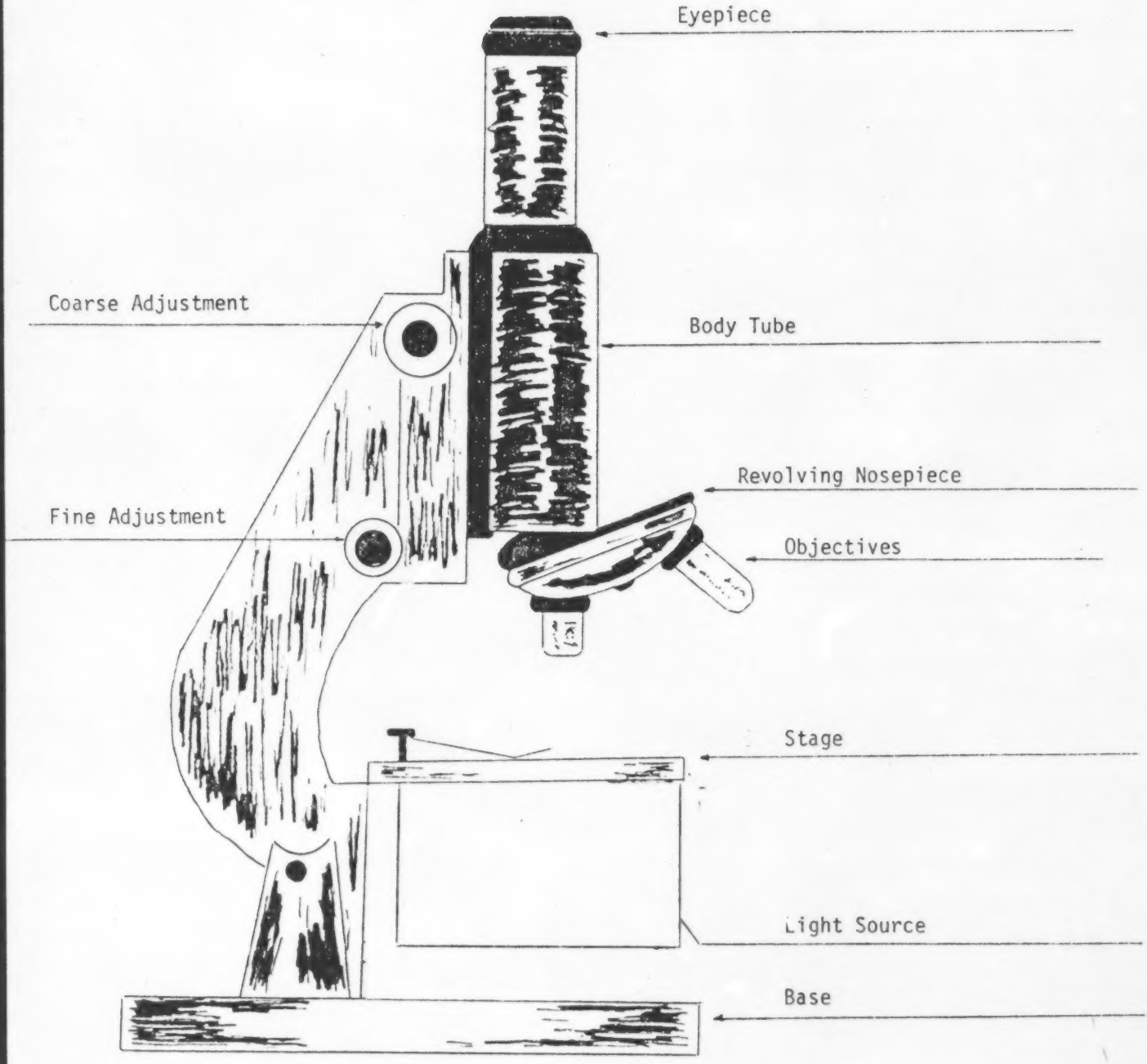
Place the cork particles on a glass slide. Using a medicine dropper, place one drop of water on the cork particles. Cover with a cover slip.

Study the diagram on the next page showing the parts of a microscope before going on further.

Place your prepared slide on the microscope stage. The proper objective to use is the one marked 10X. The eyepiece has a magnification of 10X. Together the objective and eyepiece produce a magnification 100 times larger than the actual size of the cell. Make of drawing showing the structure of the cells on your slide.

Cork Cells

M I C R O S C O P E


Eyepiece
Coarse Adjustment
Body Tube
Revolving Nosepiece
Fine Adjustment
Objectives
Stage
Light Source
Base

Cells were first observed about 300 years ago by the Englishman, Robert Hooke. He did essentially what you did in Activity 1. He thought the cells looked like little rooms much like monks lived in. The rooms were called cells so he used the same name to identify what he had observed.

Cells come in many sizes and shapes. When ooked at through a microscope, two regions can be seen. One is called the nucleus. Sometimes the nucleus cannot be seen unless it is stained with a dye. The second region is called the cytoplasm. The cytoplasm contains everything outside the nucleus. The nucleus controls the growth, reproduction, and heredity of the cell.

Most plant cells have a regular shape like small boxes with a cell wall that surrounds them. Their walls are stiff and rigid. Many plant cells contain small green bodies called chloroplasts. Photosystnesis, which is the food manufacturing process, takes place in the chloroplasts.

The walls of animal cells differ quite a lot from those of plant cells. Animal cells are not stiff or rigid and most often are irregular in shape.

If you looked at a drop of pond water under a microscope, you might see many different organisms. Some would contain many cells, but most of them would be single-celled. These single-celled organisms are too small to be seen by the naked eye. They can only be observed under a microscope. These are quite often called microorganisms.

ACTIVITY 2: LET'S LOOK AT SOME CELLS

Purpose: You now know that organisms are made up of cells. In this activity you will look at some organisms with a microscope. In this way you will get to know what different cells look like.

Materials:

celery	knife
medicine dropper	tweezers
glass slides	tincture of iodine
onion	cover slips
tomato	microscope

Procedure:

1. Onion Cells. Place a drop of water on a glass slide. Get a piece of onion from the refrigerator or the lab bench by the refrigerator. With tweezers peel off a small piece of the inner skin. Place the skin in the drop of water. Place a cover slip over the onion skin. Flatten the skin against the slide by gently pressing down on the cover slip.

2. Place the slide on the stage of the microscope. Using the objective marked 10X, focus the microscope and observe the cells. Observe the rigid wall around each cell. As the onion grew, this cell wall was formed from materials produced by the cells. Make a drawing of what you observed in the space provided below. Now switch to the high power objective. Focus and examine the cell. Look for a tiny round yellow mass in each cell. This is the nucleus.
3. Drawings of Cells

Low Power, 10X High Power, 43X

4. Cheek cells. Wash your hands. Place a drop of tincture of iodine on a slide. Using a flat toothpick, gently scrape the inside of your mouth a few times. Remove the toothpick from your mouth and carefully smear the white material from the toothpick in the tincture of iodine on the slide. Carefully place a cover slip over the smear.
5. Using the technique from step 2, observe the cells under low and high power. Make a drawing of what you observe.

Low Power High Power

6. Tomato cells. Get a small tomato from the refrigerator. Using a knife or tweezers, peel off a thin layer of skin the size of the top of a pencil eraser. Place this small piece of tomato skin in a drop of water on a slide. Place a cover slip gently over the skin.

7. Place the slide on the stage of your microscope. Observe under low and high power. Observe the cells at the edge of the torn skin. The yellow-red bodies in the cytoplasm (inner portion of cell) are called chromoplasts. They give the cells their red color.
8. Using a knife or tweezers, remove a small piece of the pulp from the tomato. Place the pulp in a drop of water on a slide. Using two toothpicks, gently pull the pulp apart. Gently press down on the pulp with a cover slip. Examine the slide under low and high power. Locate the cell walls, nuclei, and chromoplasts. Make a drawing of your observations.

9. Celery cells. Celery stalks have previously been placed in water colored with red food coloring. Get a prepared stalk from the refrigerator. Cut a 1.5 cm slice from the bottom of the long stalk, as shown in the drawing on the next page. Look at the cut edge of the 1.5 cm section. The little red circles are called xylem tubes (pronounced zilem). The tubes carry water up the celery stalk.
10. Carefully slice along the length of one of the red tubes, as shown in the drawing. Make a second slice close to the first. Place this thin section containing part of the red tube in a drop of water on a slide. Place a cover slip over the section.
    Place the slide on the stage of the microscope. Examine under low and high power. Make a drawing of what you observe. The thick cell walls help support the weight of the stalk.

Celery Stalk Cutting

Celery Cells

WATER AND SOIL ANALYSES

The National Science Foundation through a grant to the Science Education Center, University of Iowa, has funded for the last two years a program called Local Ecology Project, LEP. The purpose of LEP is to make available to the teachers of Iowa, through each Area Education Agency, water and soil testing kits. The focus of LEP is on later elementary through junior high school students and teachers. Through a program of meetings and workshops, teachers throughout Iowa have been trained in the use of these kits in both classroom and outdoor environments.

AEA 7 has a number of the La Motte Soil Testing Kits and Hach Water Testing Kits that can be checked out by teachers in AEA 7. The kits come complete with instructions for their use. Students find the instructions easy to follow. The soil testing kit is capable of determining the following elements in soil: nitrogen, phosphorus, potassium(potash), and acidity. Water test kits are capable of testing for nitrate, phosphate, ammonia, alkalinity, and dissolved oxygen in water. Contact Dr. Gil Hewett, AEA 7, for further information.

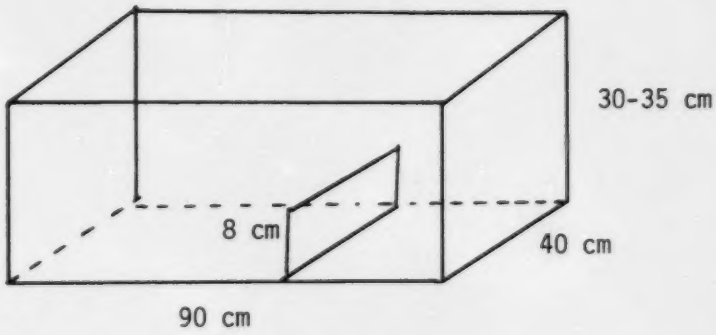
TERRQUARIUM

The terrquarium is a multi-purpose, combination terrarium and aquarium. It can be constructed from one-quarter inch plate glass or tempered glass of lesser thickness. It can also be made from an existing aquaria. Construction notes are listed below. Once the woodland-water ecosystem is established, students will be able to observe, over an extended period of time, the changes that take place within the ecosystem.

Construction

All dimensions are approximate and can be changed to fit local needs. Actual dimensions of the cut glass will vary depending on glass thickness. The front and back pieces and the two end pieces will have the same dimensions. The glass is held together and water-tight seals are made by using a clear silicone sealer that can be purchased at a hardware store. Be careful when determining the dimensions of the bottom glass. The front, back, and end pieces should rest on the bottom glass. The bottom can be cut slightly over-size.

The glass used as the partition whould be cut slightly shorter in length to allow room for the sealer. It should be about one-fourth the overall height. Seal along the bottom and both ends to make a water-tight compartment.



Procedure

Materials Required: Small gravel, sand, black soil, humus or peat moss, plants and animals.

1. Place 3 cm of gravel over the entire bottom of the terrquarium.
2. Prepare the soil by making a mixture of one part sand to three parts black soil or humus. Place on top of the gravel to a depth of about 6 cm in the front to 8-9 cm toward the side and back. The soil mixture is placed only on the terrarium side.
3. Place some small stones and pieces of natural wood in such a way as to give the terrarium a natural look.
4. The aquarium part can be given a natural appearance by placing stones and pieces of wood in the aquarium in imagnitive ways. Camouflage the glass partition so that it can not be seen. The aquarium part is not to contain fish but to be available for a turtle, frog, or snake to use. Give it the appearance of being like a small pool. Partially fill with water.
5. Visit a natural outdoor area and collect a variety of plants such as mosses, ferns, and tall and short growing plants. Bring some soil along with them and arrange in a creative way in the terrarium. Natural litter such as decayed wood, leaves, and plants will contain organisms that will do well in the terrquarium. Worms, beetles, centipedes, etc. will do well and add a natural look.
6. Toads, frogs, newts, and salamanders, or a small snake will use both the terrarium and aquarium and feel right at home in their new environment.
7. A wire mesh cover can be made to fit over the top. No framing is necessary because very little stress is placed on the sides.
8. Keep the terrquarium at a normal room temperature. Tend the plants and feed the animals their natural foods. In winter when the classroom humidity is low you may wish to place a glass cover over the terrquarium. If so, allow for the circulation of air.